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FLOOD INSURANCE STUDY

TOWN OF FLOWER MOUND, TEXAS
DENTON COUNTY

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OCTOBER 18, 1988

COMPLETED

Federal Emergency Management Agency

COMMUNITY NUMBER - 480777

ORIGINAL

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance study purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

This Flood Insurance Study was revised on October 18, 1988. Users should refer to the Revision Description section (Section 9.0) of this text for further information.

Part or all of this Flood Insurance Study may be revised at any time. The user is therefore cautioned that a published map revision (i.e., a revised Flood Insurance Rate Map) may not include a reprinting of the text, tables, and/or profiles, resulting in a discrepancy between the revised map and the original study components. It is the responsibility of the user to consult with community officials to obtain the most current Flood Insurance Study components.

Initial Flood Insurance Study Effective Date: September 18, 1986

Flood Insurance Study Revised: October 18, 1988

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FLOOD INSURANCE STUDY
TOWN OF FLOWER MOUND, TEXAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Flower Mound, Denton County, Texas, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by the Fort Worth District of the U. S. Army Corps of Engineers for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-E-0941, Project Order No. 12. This work was completed in March 1984.

1.3 Coordination

On August 17, 1982, streams to be studied by detailed methods were identified at an initial Consultation and Coordination Officer's (CCO) meeting attended by representatives of FEMA, the Town of Flower Mound, and the U. S. Army Corps of Engineers (COE - the study contractor). On November, 8,1985, the results of the study were reviewed at a final CCO meeting held with representatives of FEMA, the town, and the COE.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Flower Mound, Denton County, Texas. The area of study is shown on the Vicinity Map (Figure 1).

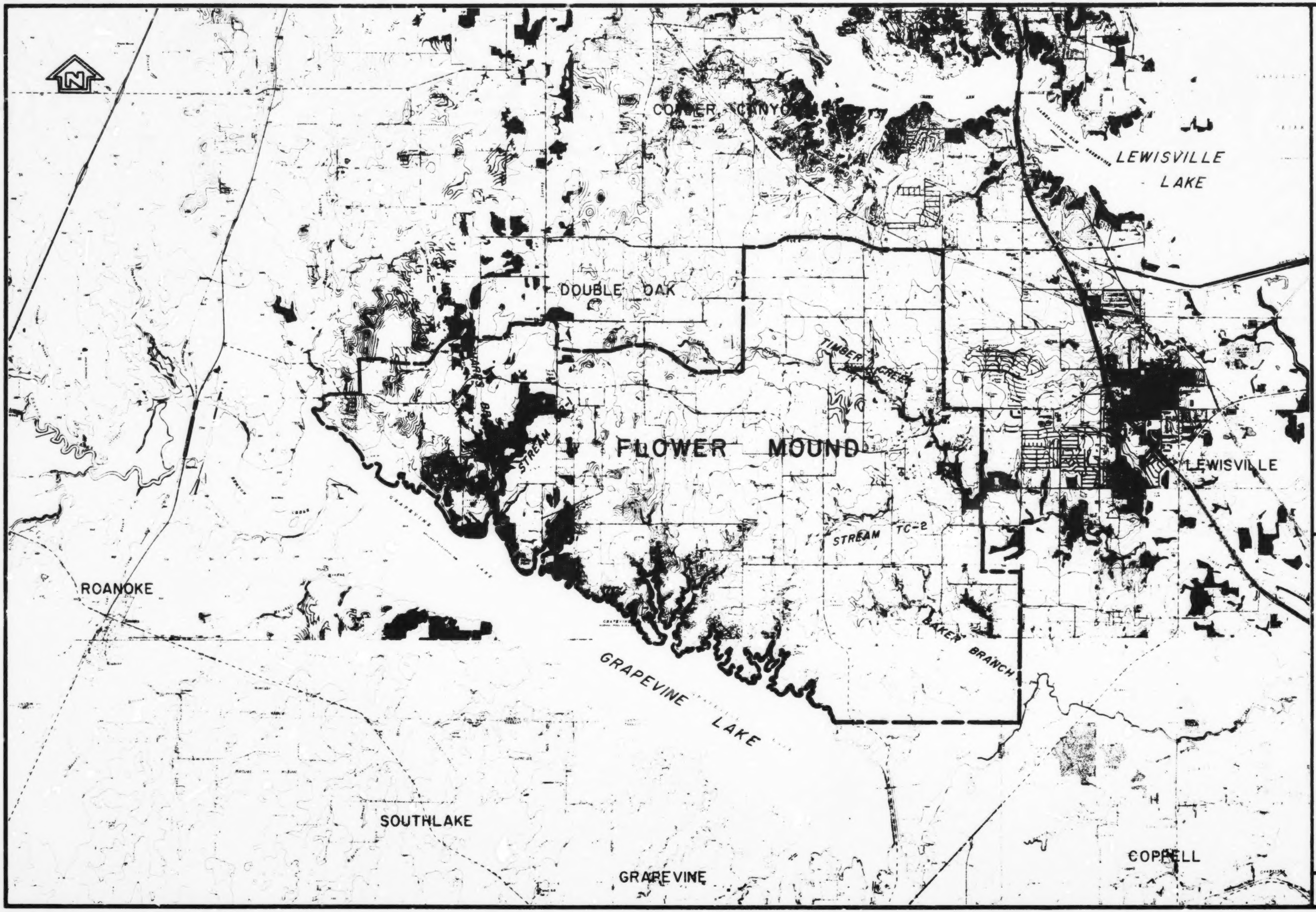
The following streams were studied by detailed methods: Bakers Branch from approximately 1,500 feet upstream of its confluence with Denton Creek to approximately 0.6 mile upstream of Gerault Road; Sharps Branch from the downstream corporate limits to approximately 1.3 miles upstream; Stream SB-1 from its confluence with Sharps Branch to approximately 0.6 mile upstream; Stream TC-2 from its confluence with Timber Creek to approximately 0.4 mile upstream of Long Prarie Road; and Timber Creek from the downstream corporate limits to approximately 1.1 miles upstream of Mesquite Street. Flooding from Denton Creek (located outside the corporate limits) and Grapevine Lake was also studied in detail. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through March 1989.

Several unnamed tributaries and the remaining portions of Bakers Branch, Sharps Branch, Stream SB-1, and TC-2 within the corporate limits were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the Town of Flower Mound.

2.2 Community Description

The Town of Flower Mound is located in the southeastern portion of Denton County in north-central Texas, approximately 24 miles northwest of the City of Dallas. It is bordered by the City of Highland Village, the Town of Double Oak, and unincorporated areas of Denton County to the north, the City of Lewisville and unincorporated areas of Denton County to the east, the City of Grapevine to the south, and the City of Westlake and unincorporated areas of Denton County to the west. According to the U. S. Bureau of the Census, the population of Flower Mound was 1,685 in 1970 and 4,402 in 1980 (References 1 and 2). The total land area contained within the corporate limits of the town is 30.1 square miles.

Bakers Branch flows southeast through the southeastern part of the town. It is approximately 4 miles long and has a drainage area of 2.8 square miles.



APPROXIMATE SCALE

VICINITY MAP

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX

(DENTON CO.)

FIGURE 1

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Sharps Branch flows south into Grapevine Lake in the western portion of the town. It has a length of approximately 4.5 miles, of which 2.8 miles are within the town. The drainage area of Sharps Branch is approximately 5 square miles.

Stream SB-1 flows south into Sharps Branch in the western portion of the town. It is approximately 1.7 miles long and has a drainage area of approximately 1.2 square miles.

Stream TC-2 flows east into Timber Creek in the central portion of the town. It is approximately 4.1 miles long, with a drainage area of approximately 3.3 square miles.

Timber Creek flows east through the northeastern portion of Flower Mound. The stream is approximately 16.7 miles long, with approximately 5.1 miles affecting the town. The drainage area of Timber Creek is more than 21 square miles.

Denton Creek flows west just outside the southeastern corporate limits of the town. It is approximately 17 miles in length, with approximately 1.6 miles affecting the community. Its drainage area is over 70 square miles.

The climatological data for the City of Fort Worth are considered indicative of the conditions prevailing in the region. The average annual rainfall was 32.30 inches for the last 10-year period. The maximum and minimum annual rainfall occurring during the last 57 years was 51.03 inches in 1932 and 17.91 inches in 1921, respectively. The mean relative humidity is 65 percent, and the average annual temperature is 65.8 degrees Fahrenheit (Reference 3).

2.3 Principal Flood Problems

Timber Creek flooded on October 13, 1981, but the extent of the damage is not known. No other information concerning flooding within the town is available.

2.4 Flood Protection Measures

Non-structural measures of flood protection in the form of land-use regulations and ordinances are being used to aid in the prevention of future flood damage.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency and peak elevation-frequency relationships for the flooding sources studied in detail affecting the community.

The computer program NUDALLAS was used in developing the hydrology for the streams studied by detailed methods (Reference 4). The watershed was divided into sub-areas, and synthetic unit and flood hydrographs were developed at selected locations. Technical Paper No. 40 and Technical Memorandum NWS Hydro-35 were used in developing the 10-, 50-, and 100-year frequency storms (References 5 and 6). The 500-year storm was based on extrapolated data. Peak discharge-frequency values were computed for selected locations. Routing of the flood hydrographs through each sub-basin was accomplished using a modified Puls reservoir routing. The COE HEC-2 step-backwater computer model provided the elevation-discharge-storage relationships for the streams studied by detailed methods (Reference 7).

A summary of drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges." For Timber Creek, storage in the overbanks caused discharges to decrease downstream at two discharge points.

TABLE 1 - SUMMARY OF DISCHARGES

	DRAINAGE AREA	PEAK DISCHARGES (cfs)			
FLOODING SOURCE AND LOCATION	(sq. miles)	10-YEAR	50-YEAR	100-YEAR	500-YEAR
BAKERS BRANCH					
At its confluence with Denton Creek	2.84	3,650	5,050	5,650	6,850
Approximately 750 feet upstream of Gerault Road	1.45	2,550	3,450	3,850	4,750
Approximately 850 feet upstream of Gerault Road	1.20	2,150	2,900	3,300	4,050
Approximately 2,300 feet upstream of Gerault Road	0.69	1,600	2,100	2,300	2,900
SHARPS BRANCH					
Approximately 100 feet downstream of the confluence of Stream SB-1	3.39	4,650	6,300	7,100	8,600
Approximately 100 feet upstream of the confluence of Stream SB-1	2.18	3,100	4,200	4,700	5,700
Approximately 100 feet downstream of FM 1171	1.44	2,200	3,000	3,350	4,050
STREAM SB-1					
At its confluence with Sharps Branch	1.21	1,600	2,200	2,450	3,000
STREAM TC-2					
At its confluence with Timber Creek	3.30	3,800	5,300	5,950	7,300
At Garden Road	2.31	3,100	4,250	4,750	5,800
Approximately 1,000 feet downstream of FM 2499	1.37	2,850	3,950	4,250	5,250
Approximately 900 feet downstream of FM 2499	1.03	2,050	2,700	3,000	3,750
At Old Settlers Road	0.41	950	1,250	1,350	1,700
TIMBER CREEK					
At Old Orchard Lane	14.55	8,410	12,100	14,000	18,100
Approximately 100 feet upstream of the confluence of Stream TC-2	10.34	5,270	8,110	9,610	12,700
At FM 1171	9.32	5,070	7,940	9,410	12,400
Approximately 920 feet upstream of Timber Creek Road	8.63	5,100	8,010	9,460	12,600

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
TIMBER CREEK (continued)					
Approximately 1,400 feet upstream of Morris Road	7.38	4,910	7,600	8,910	11,600
Approximately 1,600 feet upstream of Morris Road	6.11	4,150	6,360	7,440	9,660
Approximately 3,800 feet upstream of Mesquite Road	4.70	4,660	6,890	7,930	9,960
DENTON CREEK					
Upstream of the confluence of Bakers Branch	5.63	6,600	9,100	10,200	36,200[1]

[1] Releases from Grapevine Lake Emergency Spillway

For Grapevine Lake, the 10-, 50-, 100-, and 500-year elevations were obtained from the Flood Insurance Study for Denton County (Reference 8). A summary of peak elevation-frequency relationships for Grapevine Lake is shown in Table 2, "Summary of Stillwater Elevations."

TABLE 2 - SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
GRAPEVINE LAKE				
Entire shoreline within community	554.0	562.3	564.0	568.4

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the backwater analyses were field surveyed. Cross sections were located at close intervals above and below bridges and culverts in order to compute the significant backwater effects of these structures.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 7). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for the streams studied by detailed methods were determined by the slope/area method.

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and flood plain areas. The channel "n" and overbank "n" values for the streams studied by detailed methods are shown in the following tabulation:

Stream	Channel "n"	Overbank "n"
Bakers Branch	0.060-0.075	0.070-0.095
Sharps Branch	0.065-0.070	0.085-0.100
Stream SB-1	0.070	0.100
Stream TC-2	0.050-0.055	0.080
Timber Creek	0.025-0.070	0.050-0.085
Denton Creek	0.045	0.040-0.060

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each flooding source studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps (Reference 9).

For the streams studied by approximate methods, the boundary of the 100-year flood was delineated using the topographic maps referenced above, the Flood Hazard Boundary Map for Flower Mound, and engineering judgment (References 9 and 10).

The 100- and 500-year flood plain boundaries are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 3).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood plain boundaries are either close together or collinear, only the floodway boundary has been shown.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Bakers Branch								
A	3,570[1]	210	1,459	3.9	477.1	477.1	477.6	0.5
B	6,420[1]	149	1,476	3.8	485.9	485.9	486.7	0.8
C	8,230[1]	99	1,090	5.2	493.6	493.6	494.4	0.8
D	10,180[1]	80	688	8.2	504.7	504.	505.5	0.8
E	11,690[1]	80	805	4.8	521.6	521.6	522.3	0.7
F	12,700[1]	100	682	5.6	529.0	529.0	529.8	0.8
G	13,650[1]	80	652	5.1	533.5	533.5	534.0	0.5
H	14,870[1]	50	417	7.9	541.2	541.2	542.0	0.8
I	16,000[1]	50	413	5.6	549.6	549.6	550.5	0.9
Sharps Branch								
A	9,440[2]	180	748	6.3	564.1	564.1	564.2	0.1
B	11,000[2]	180	911	5.2	574.9	574.9	575.0	0.1
C	12,750[2]	224	964	4.9	588.0	588.0	589.0	1.0
D	14,600[2]	150	682	4.9	601.4	601.4	602.1	0.7
Stream SB-1								
A	2,700[3]	*	*	*	569.5	569.5	570.3	0.8
Stream TC-2								
A	1,140[4]	100	750	7.9	536.6	536.6	536.7	0.1
B	2,520[4]	125	883	6.7	545.8	545.8	546.8	1.0
C	4,140[4]	150	934	6.4	555.3	555.3	555.9	0.6

[1] Feet above confluence with Denton Creek

[2] Feet above confluence with Grapevine Lake

[3] Feet above confluence with Sharps Branch

[4] Feet above confluence with Timber Creek

*Floodway within government property fee and/or flowage easement limits; COE flood plain regulations are more restrictive

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX
(DENTON CO.)

FLOODWAY DATA

BAKERS BRANCH - SHARPS BRANCH - STREAM SB-1 - TC-2

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						(FEET NGVD)		
Stream TC-2 (continued)								
D	6,550[1]	201	979	4.9	565.2	565.2	566.2	1.0
E	8,270[1]	150	898	5.3	571.0	571.0	571.6	0.6
F	11,480[1]	175	944	4.5	585.0	585.0	585.1	0.1
G	14,270[1]	209	674	4.5	596.1	596.1	596.4	0.3
H	16,140[1]	160	227	5.9	606.4	606.4	606.4	0.0
Timber Creek								
A	42,750[2]	230/60[3]	3,140	4.5	532.8	532.8	533.6	0.8
B	43,500[2]	200/150[3]	2,350	6.0	534.0	534.0	534.7	0.7
C	45,110[2]	120	1,375	7.0	537.0	537.0	537.5	0.5
D	46,200[2]	130	1,664	5.8	539.5	539.5	540.2	0.7
E	48,400[2]	161	1,535	6.1	545.9	545.9	546.8	0.9
F	50,720[2]	200	1,901	4.9	555.4	555.4	556.4	1.0
G	52,540[2]	350	2,845	3.3	563.6	563.6	564.4	0.8
H	53,940[2]	570	2,851	3.3	566.8	566.8	567.8	1.0
I	54,710[2]	449	3,899	2.4	568.1	568.1	568.9	0.8
J	56,060[2]	450	3,234	2.9	569.2	569.2	570.2	1.0
K	59,630[2]	375	2,434	3.1	575.1	575.1	576.1	1.0
L	64,400[2]	400	1,895	3.5	585.4	585.4	585.8	0.4
M	67,100[2]	300	1,766	4.5	591.7	591.7	592.3	0.6
N	69,710[2]	430	2,080	3.8	596.3	596.3	597.0	0.7

[1] Feet above confluence with Timber Creek

[2] Feet above Elm Fork of Trinity River

[3] Width/width within corporate limits

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

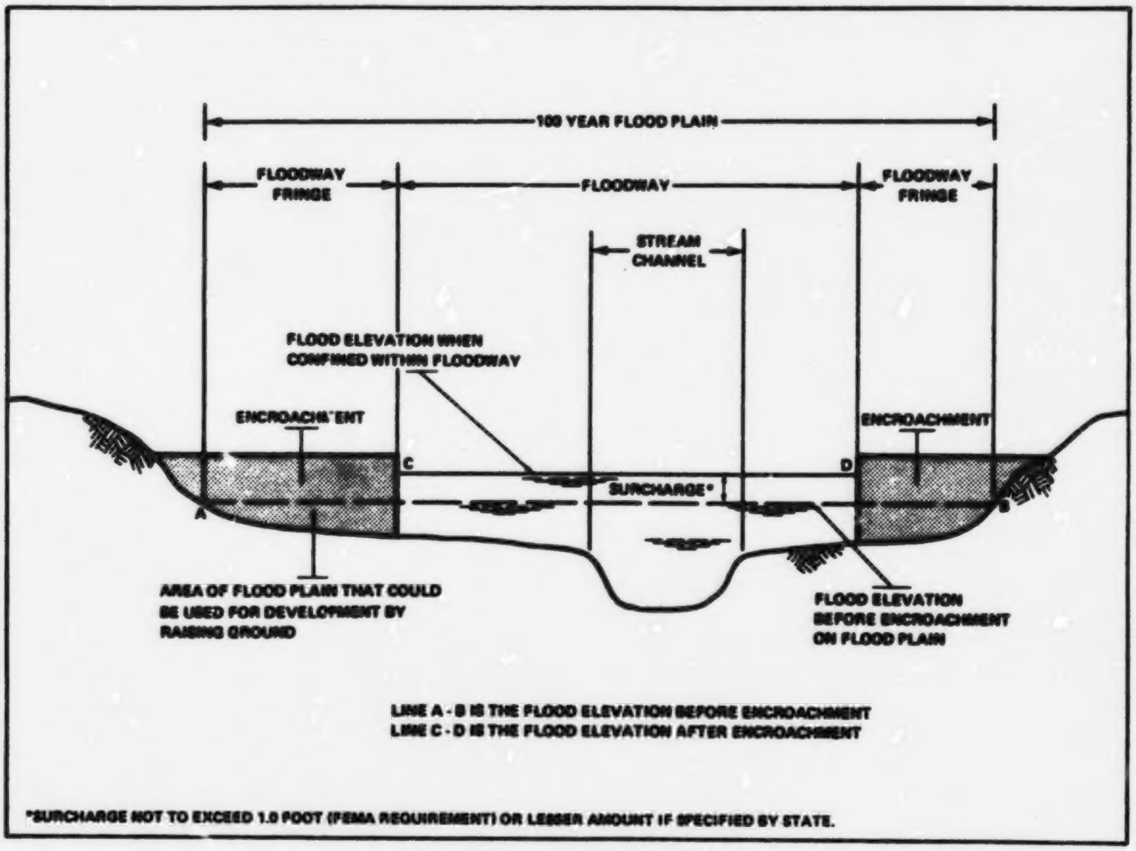
TOWN OF FLOWER MOUND, TX

(DENTON CO.)

FLOODWAY DATA

Stream TC-2 Timber Creek

The area between the floodway and 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 2

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail in the Town of Flower Mound.

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5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following tabulation for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of the Town of Flower Mound are shown on the Flood Profiles (Exhibit 1) and summarized in Table 4.

In lacustrine areas, reaches are limited to the distance for which the 100-year flood elevation does not vary more than 1.0 foot. Using these criteria, one reach was required for the lacustrine flooding source of the Town of Flower Mound. The location of this reach is shown on the Flood Insurance Rate Map and summarized in Table 4.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one-half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Bakers Branch							
Reach 1	05,15	-1.7	-0.4	+0.8	015	A3	Varies
Sharps Branch							
Reach 1	10	-1.7	-0.5	+0.8	015	A3	Varies
Reach 2	10	-0.9	-0.2	+0.4	010	A2	Varies
Stream SB-1							
Reach 1	10	-1.2	-0.3	+0.6	010	A2	Varies
Stream TC-2							
Reach 1	15	-1.2	-0.3	+0.6	010	A2	Varies
Timber Creek							
Reach 1	05,15	-2.7	-0.8	+1.4	025	A5	Varies
Reach 2	05	-1.8	-0.5	+0.9	020	A4	Varies
Reach 3	05	-0.8	-0.2	+0.4	010	A2	Varies

[1] Flood Insurance Rate Map Panel

[2] Weighted Average

[3] Rounded to the nearest foot - see map

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX
(DENTON CO.)

FLOOD INSURANCE ZONE DATA

Bakers Branch Sharps Branch Stream SB-1
Stream TC-2 Timber Creek

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Denton Creek							
Reach 1	05	-1.4	-0.4	+2.6	015	A3	Varies
Reach 2	05	-2.9	-0.7	+5.3	030	A6	Varies
Grapevine Lake							
Reach 1	10,15	-10.0	-1.7	+4.4	100	A20	564
McKamy Creek							
Reach 1	15	-1.4	-0.5	+0.9	015	A3	Varies
Tributary 1 to McKamy Creek							
Reach 1	15	-0.7	-0.3	+0.5	005	A1	Varies

[1] Flood Insurance Rate Map Panel
[2] Weighted Average
[3] Rounded to the nearest foot - see map

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX
(DENTON CO.)

FLOOD INSURANCE ZONE DATA

DENTON CREEK - GRAPEVINE LAKE - MC KAMY CREEK - TRIBUTARY 1 TO MC KAMY CREEK associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zones A2, A3, A4, A5, A6, and A20:	Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding; not subdivided.

Flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the community are shown in Table 4.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Town of Flower Mound is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

6.0 OTHER STUDIES

Flood Insurance Studies for the unincorporated areas of Denton County and the City of Lewisville are currently being prepared (References 8 and 11). The results of those studies will be in exact agreement with the results of this study.

Due to a more detailed analysis, this study supersedes the published Flood Hazard Boundary Map for Flower Mound (Reference 10).

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, Federal Regional Center, 800 North Loop 288, Denton, Texas 76201-3698.

8.0 BIBLIOGRAPHY AND REFERENCES

1. U. S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, Texas, Washington, D. C., U. S. Government Printing Office, 1981.

2. A. M. Belo Corporation, Texas Almanac, 1982-1983, 1981.

3. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service, Monthly and Annual Climatological Data for State (Texas), Asheville, North Carolina, National Climatic Center.

4. U. S. Army Corps of Engineers, Fort Worth District, Computer Program NUDALLAS, Fort Worth, Texas, Revised September 1982.

5. U. S. Department of Commerce, Weather Bureau, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, Washington, D. C., 1961, Revised 1963.

6. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Technical Memorandum NWS Hydro-35, Five- to 60-Minute Precipitation Frequency for the Eastern and Central United States, Washington, D. C., June 1977.

7. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, January 1981.

8. Federal Emergency Management Agency, Flood Insurance Study, Unincorporated Areas of Denton County, Texas (Unpublished).

9. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 10 Feet: Argyle, Texas, 1973, Photorevised 1981; Lewisville West, Texas, 1960, Photorevised 1973; Grapevine, Texas, 1959, Photorevised 1973.

10. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Town of Flower Mound, Denton County, Texas, October 29, 1976.

11. Federal Emergency Management Agency, Flood Insurance Study, City of Lewisville, Denton County, Texas (Unpublished).

TEXT REVISIONS
TOWN OF FLOWER MOUND, DENTON COUNTY, TEXAS

9.0 REVISION DESCRIPTION

9.1 Purpose

The purpose of this revision is to incorporate new and/or revised data into the currently effective Flood Insurance Study for the Town of Flower Mound, Denton County, Texas. This Revision Description is intended to provide updated information that aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

9.2 Acknowledgments

The hydrologic and hydraulic analyses in this Revision Description for McKamy Creek and Tributary 1 to McKamy Creek were prepared by Caffey and Morrison, Inc. This work was completed in April 1986. The Federal Emergency Management Agency (FEMA) reviewed and accepted these data for purposes of this revision.

9.3 Scope

This revision reflects the development of detailed hydrologic and hydraulic analyses for McKamy Creek from the Government Easement Boundary of Grapevine Lake to the downstream side of Flower Mound Road and for Tributary 1 to McKamy Creek from its confluence with McKamy Creek to approximately 1,500 feet upstream of the confluence. Flood Insurance Rate Map (FIRM) panel 0015A and Flood Boundary and Floodway Map (FBFM) 0015 were revised to include the new detailed data.

9.4 Hydrologic and Hydraulic Analyses

The hydrologic calculations for McKamy Creek and Tributary 1 to McKamy Creek were developed using the U. S. Army Corps of Engineers (COE) HEC-1 computer program (Reference 1).

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods in the original study is shown in Table 1, "Summary of Discharges." An addendum for Table 1 was made for McKamy Creek and Tributary 1 to McKamy Creek and is shown in Table A, "Summary of Discharges Addendum."

TABLE A - SUMMARY OF DISCHARGES ADDENDUM

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-YEAR	50-YEAR	100-YEAR	500-YEAR
McKAMY CREEK					
Approximately 1,000 feet downstream of confluence of Tributary 1 to McKamy Creek	0.64	1,590	2,190	2,540	3,320
Immediately upstream of confluence of Tributary 1 to McKamy Creek	0.33	840	1,160	1,340	1,750
At Flower Mound Road	0.22	620	860	1,000	1,310
TRIBUTARY 1 TO McKAMY CREEK					
At confluence with McKamy Creek	0.15	430	580	680	900

The hydraulic calculations for McKamy Creek and Tributary 1 to McKamy Creek were developed using the COE HEC-2 step-backwater computer program (Reference 2). Water-surface elevations were computed for the 10-, 50-, 100-, and 500-year frequency floods for existing conditions. These areas were previously shown as Zone A on the FIRM dated September 18, 1986. The new analyses are shown on profile panels 14P-16P. The locations of the reaches determined for McKamy Creek and Tributary 1 to McKamy Creek are summarized in Table 4, "Flood Insurance Zone Data."

9.5 Revision Bibliography

1. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-1 Flood Hydrograph Package, Davis, California, February 1985.

2. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Davis, California, August 1985.

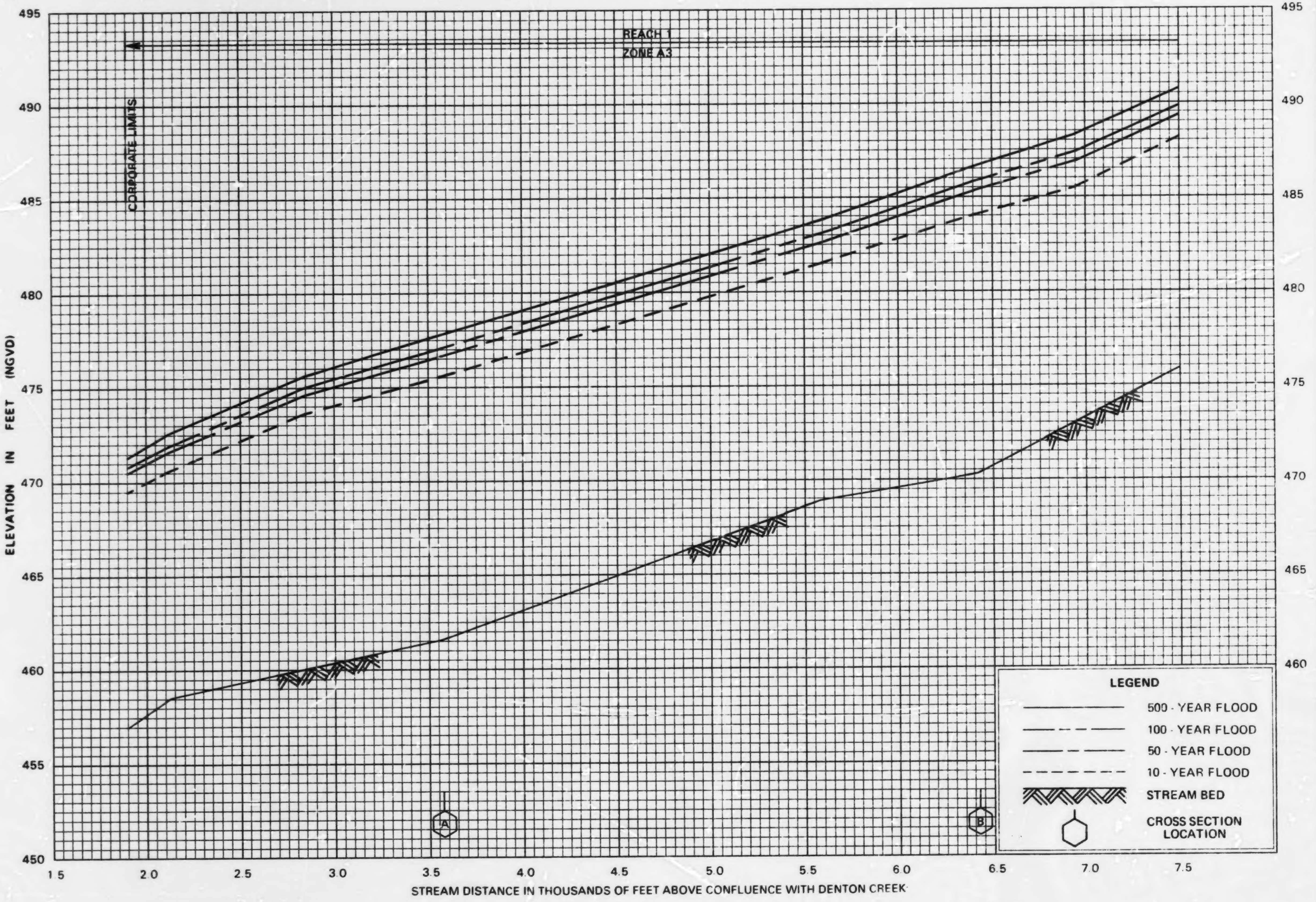
ATTACHMENT

Town of Flower Mound,
Denton County, Texas

The effective Flood Insurance Rate Map (FIRM), panel 0015 A, dated September 18, 1986, has been revised to reflect detailed hydrologic and hydraulic analyses of McKamy Creek and Tributary 1 to McKamy Creek. The flooding associated with these streams is currently shown on the effective FIRM as areas of approximate flooding (i.e., where no Base Flood Elevations [BFEs] have been determined). The analyses were performed by Caffey and Morrison, Inc., of Arlington, Texas.

McKamy Creek has now been studied by detailed methods from the Government Easement Boundary of Grapevine Lake to the downstream side of Flower Mound Road. Tributary 1 to McKamy Creek has now been studied from its confluence with McKamy Creek to approximately 1,500 feet upstream of the confluence. BFEs, flood hazard zone designations, and 100- and 500-year flood boundaries have been established for both streams; however, floodways have not been established.

The Flood Insurance Study and the Flood Insurance Zone Data Table (FIZDT) have been revised, and flood profiles 14P-16P have been created to reflect the new hydrologic and hydraulic analyses. We are enclosing the revised FIZDT and the above-mentioned profiles with the revised FIRM.



FLOOD PROFILES

BAKERS BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX
(DENTON CO.)

01P

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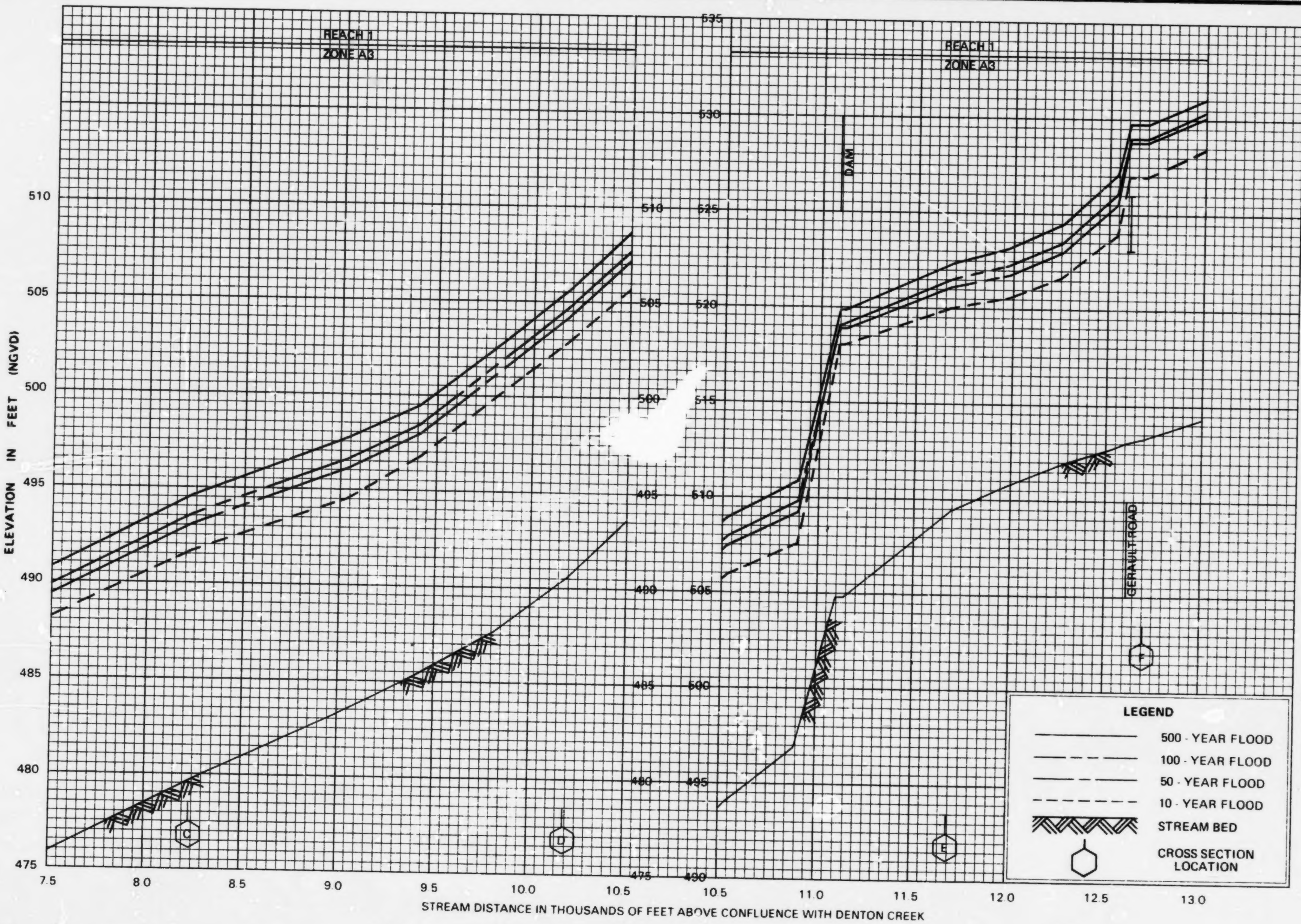

FLOOD PROFILES

BAKERS BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX

(DENTON CO.)

02P

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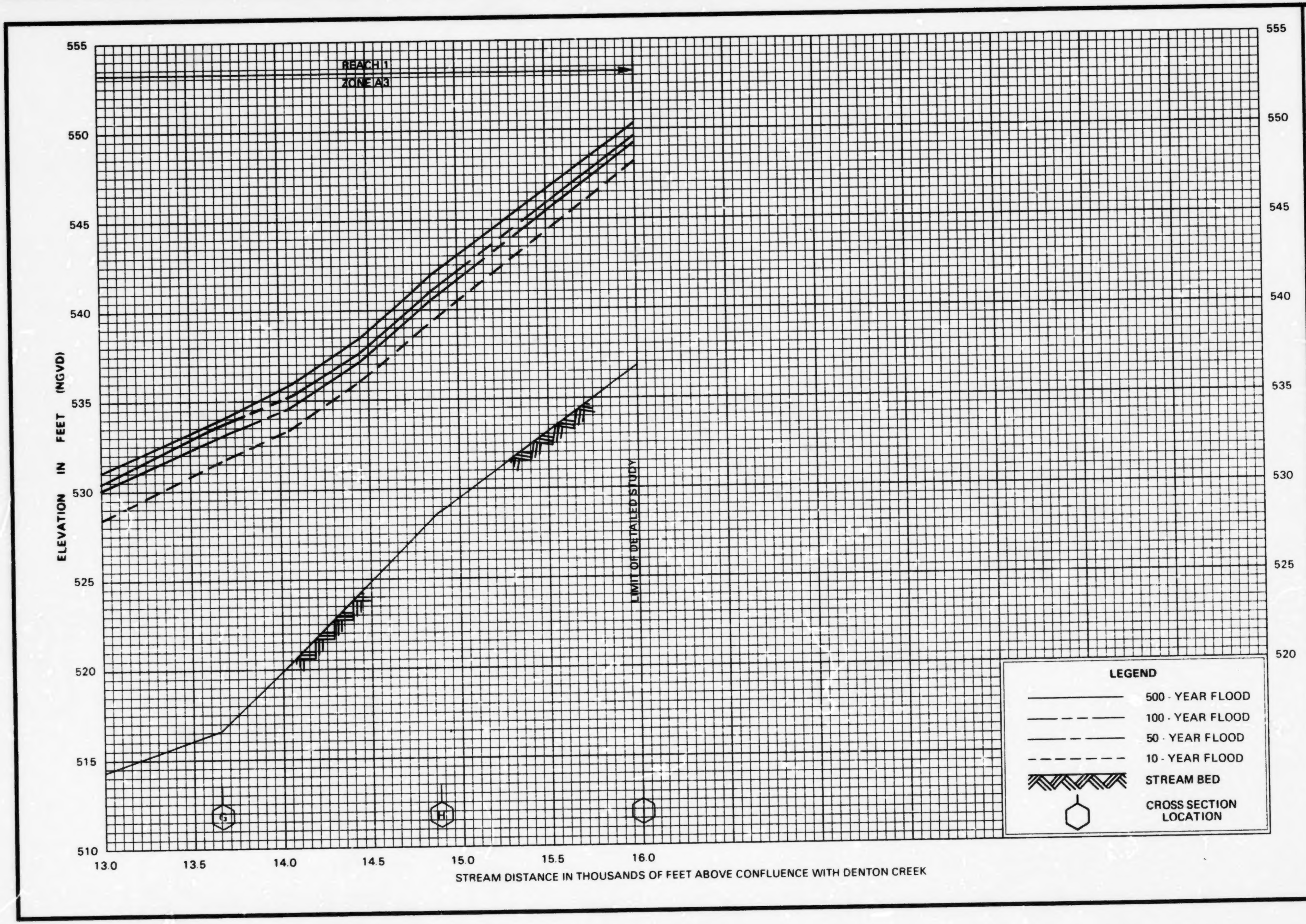

FLOOD PROFILES

BAKERS BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX

(DENTON CO.)

03P

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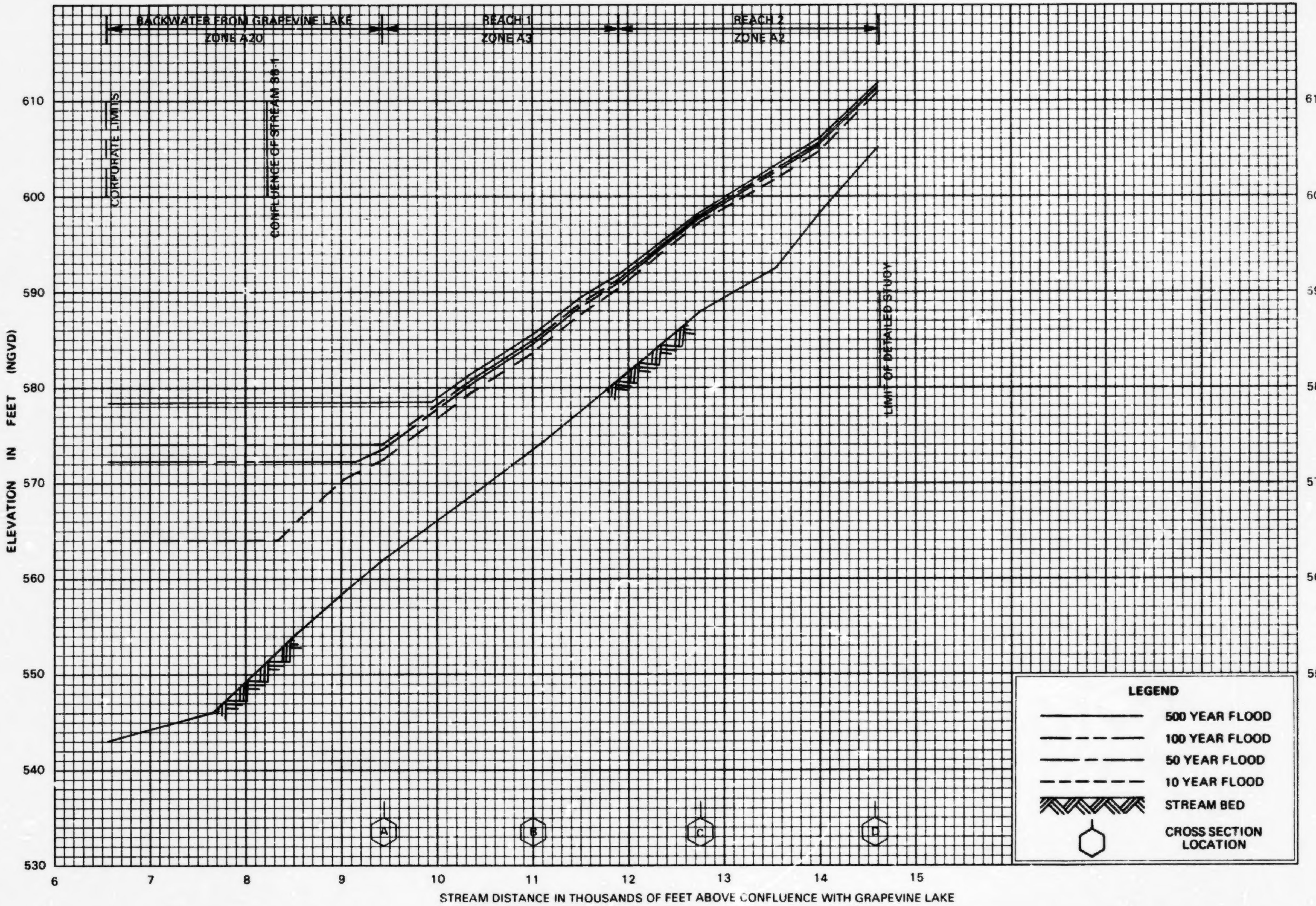

FLOOD PROFILES

SHARPS BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX
(DENTON CO.)

04P

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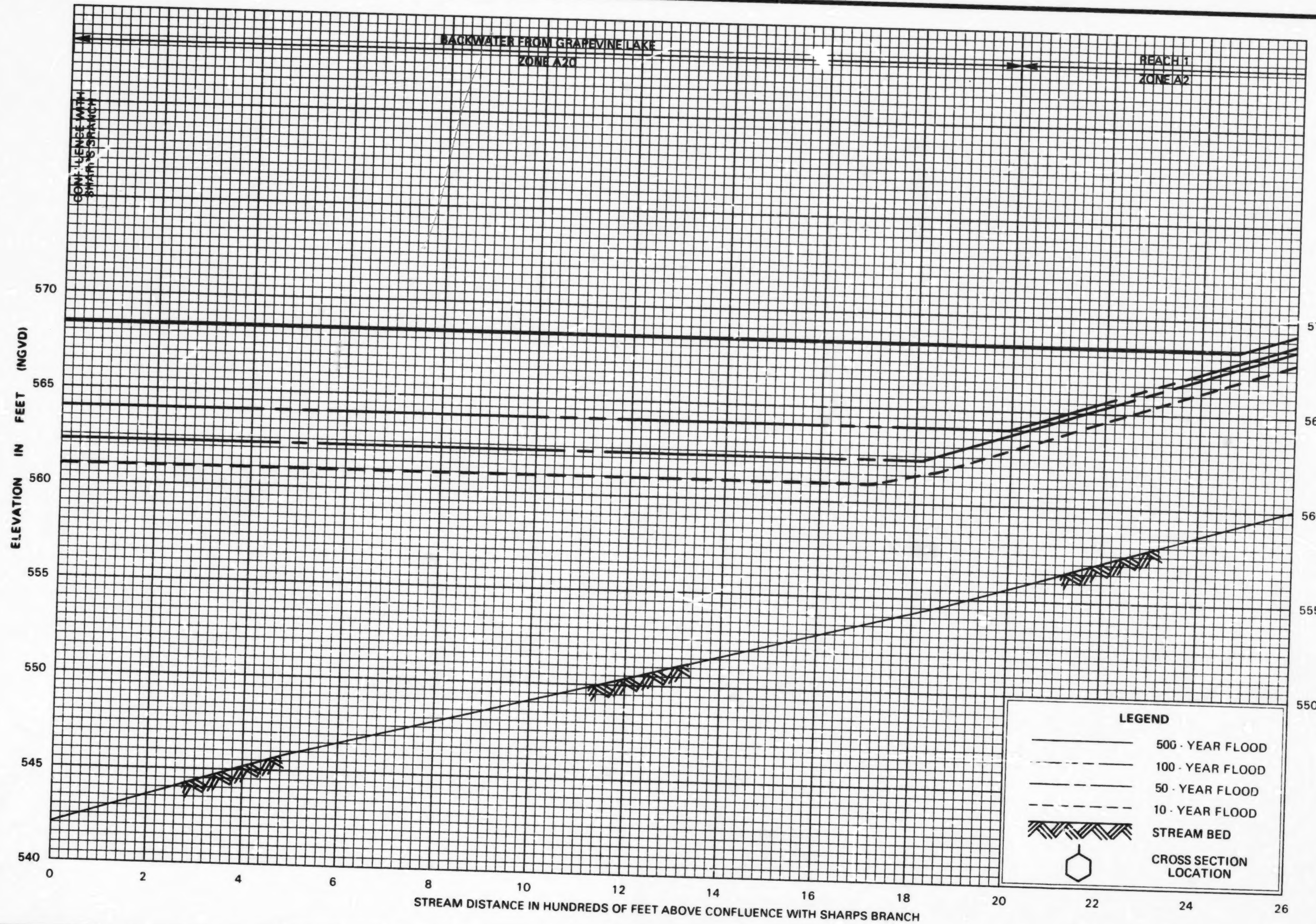

FLOOD PROFILES

STREAM SB-1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX

(DENTON CO.)

05P

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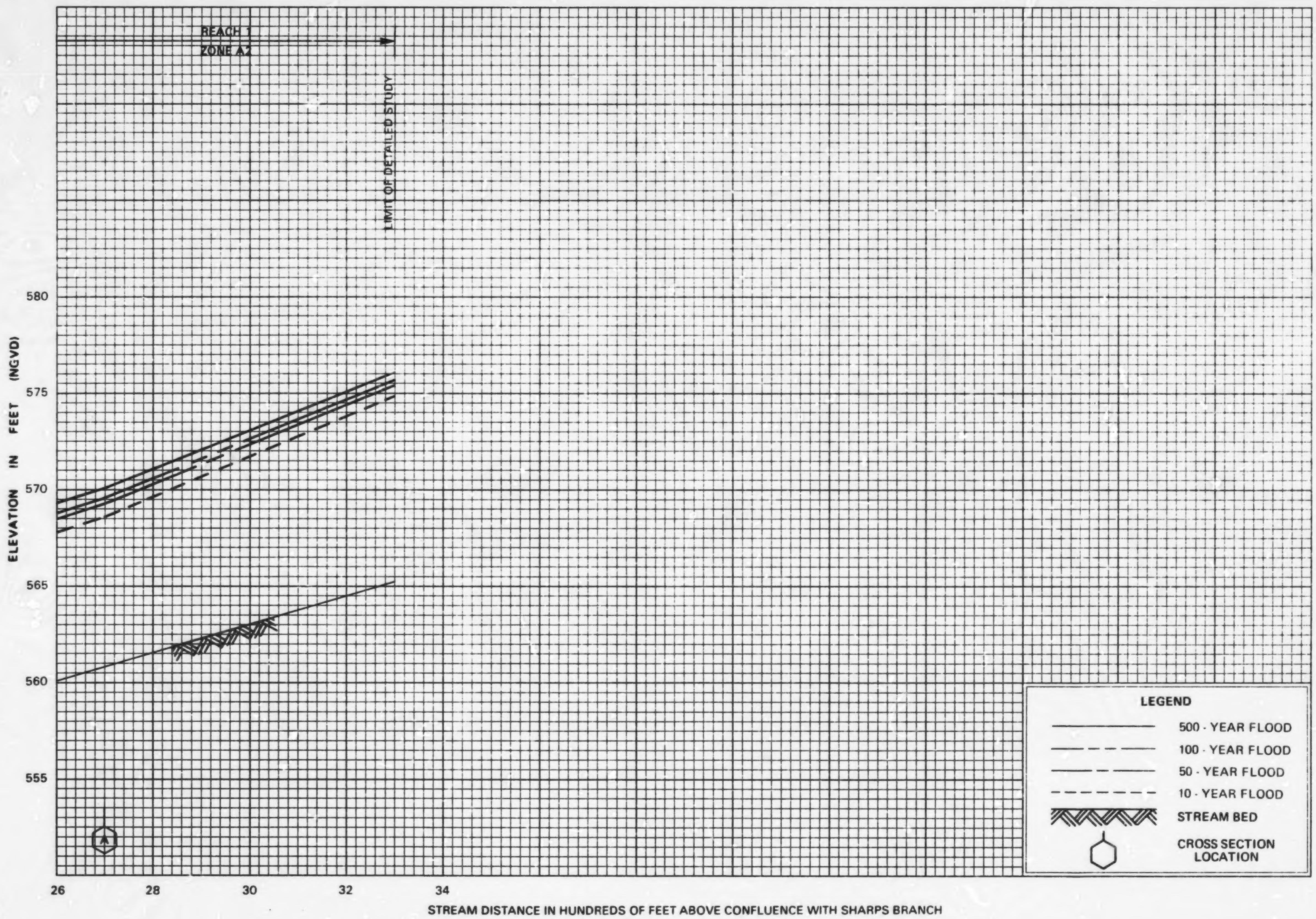

FLOOD PROFILES

STREAM SB-1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX

(DENTON CO.)

06P

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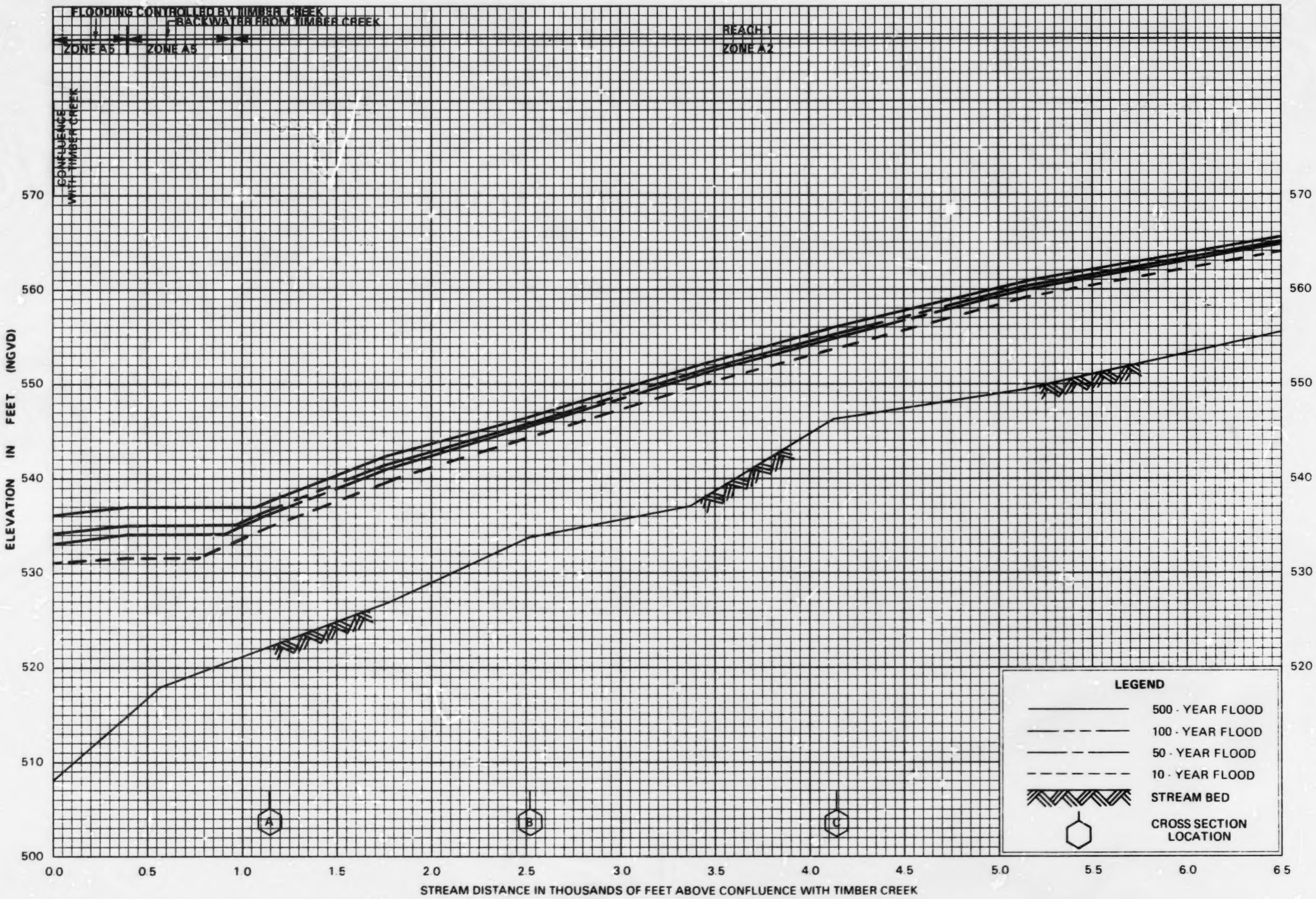

FLOOD PROFILES

STREAM TC-2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX

(DENTON CO.)

07P

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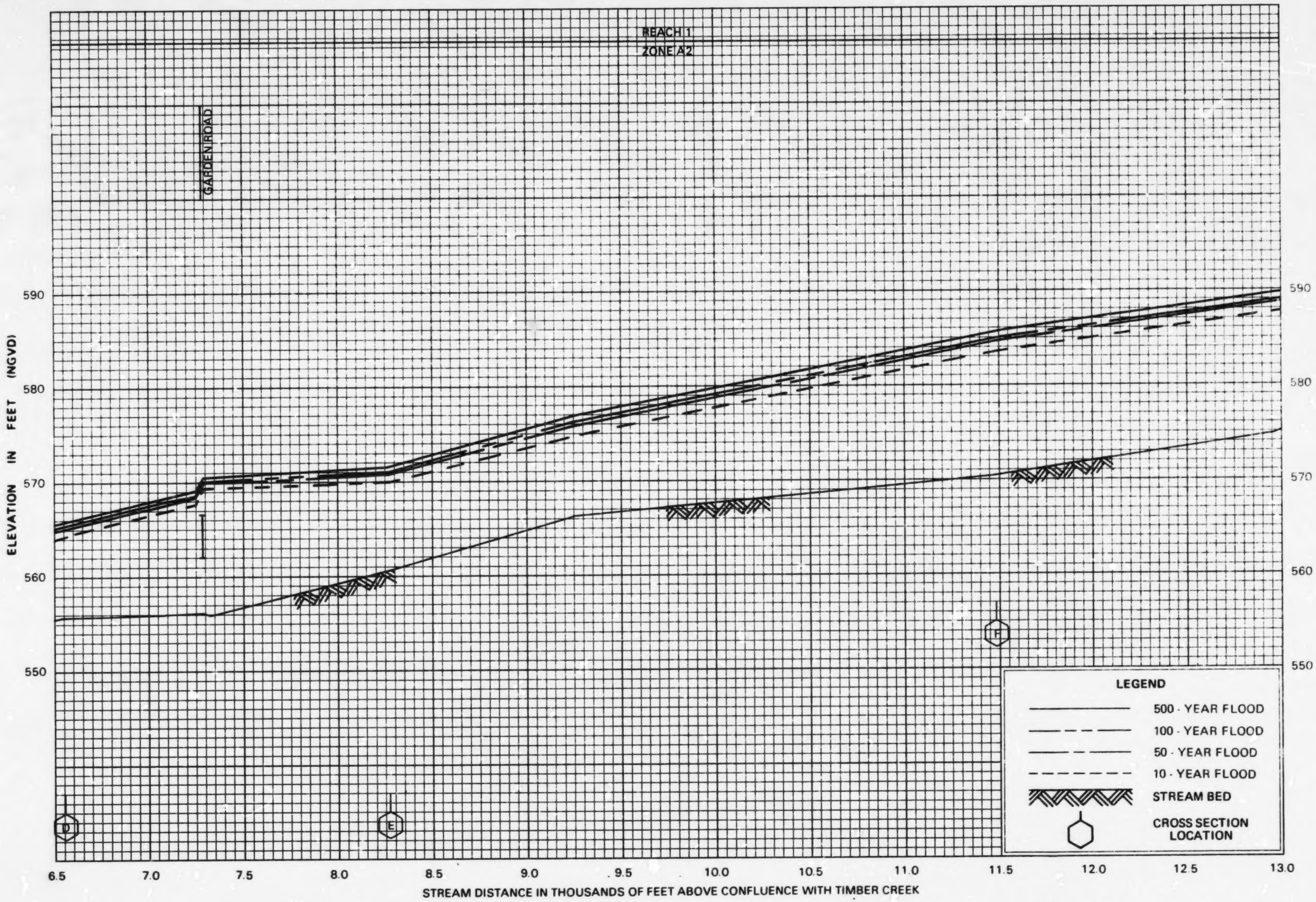

FLOOD PROFILES

STREAM TC-2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX

(DENTON CO.)

08P

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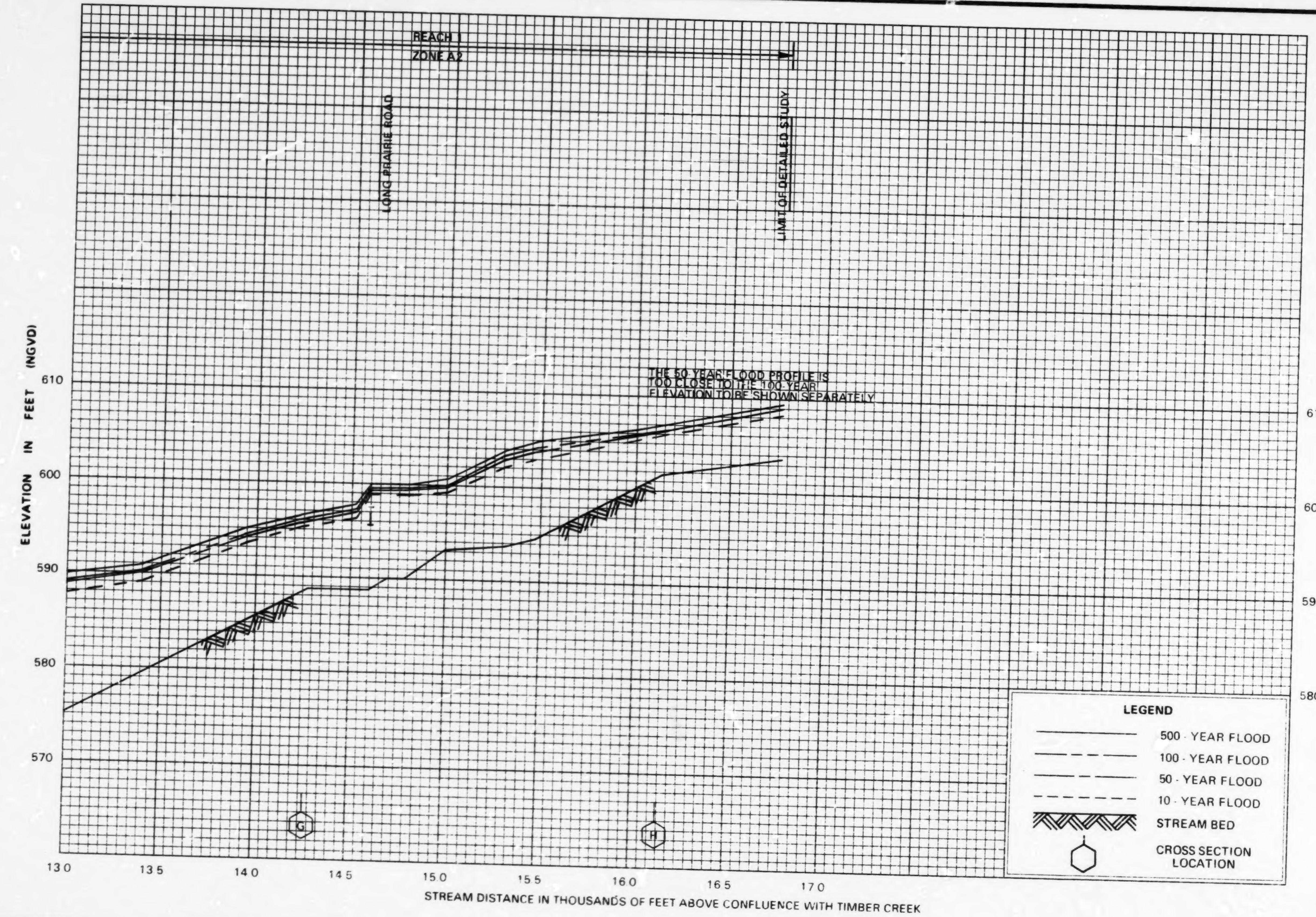

FLOOD PROFILES

STREAM TC-2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX

(DENTON CO.)

09P

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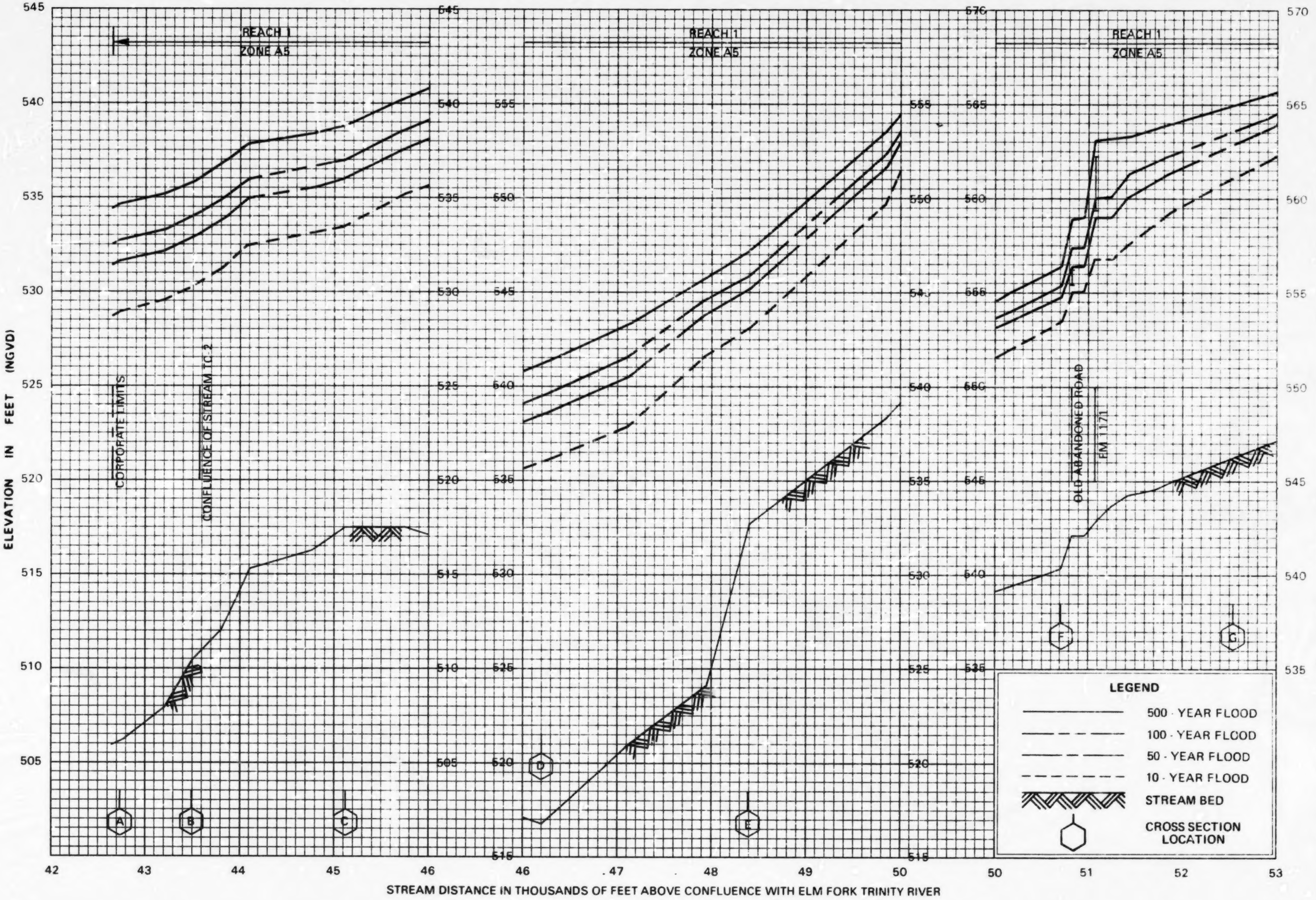

FLOOD PROFILES

TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX

(DENTON CO.)

10P

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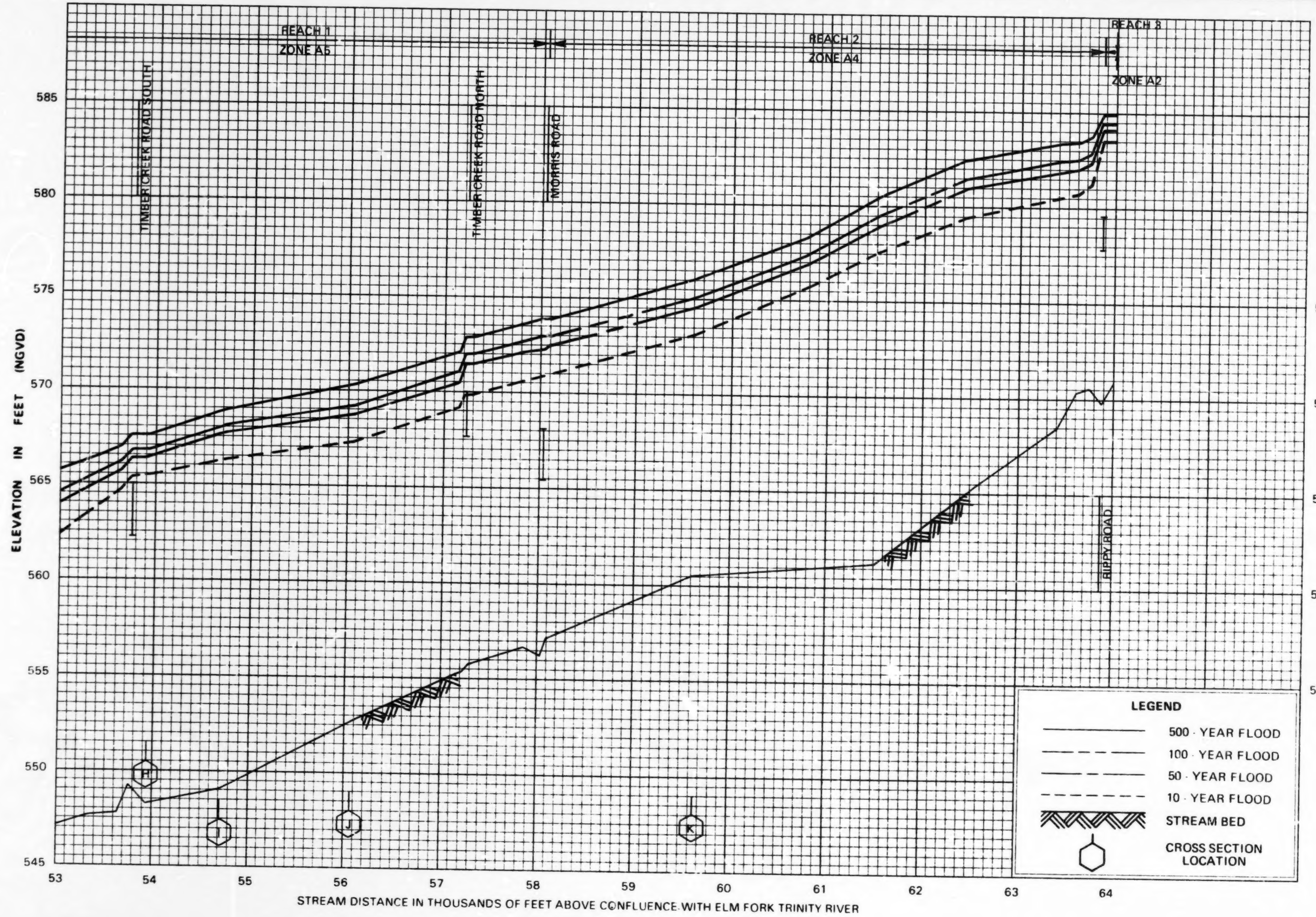

FLOOD PROFILES

TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX

(DENTON CO.)

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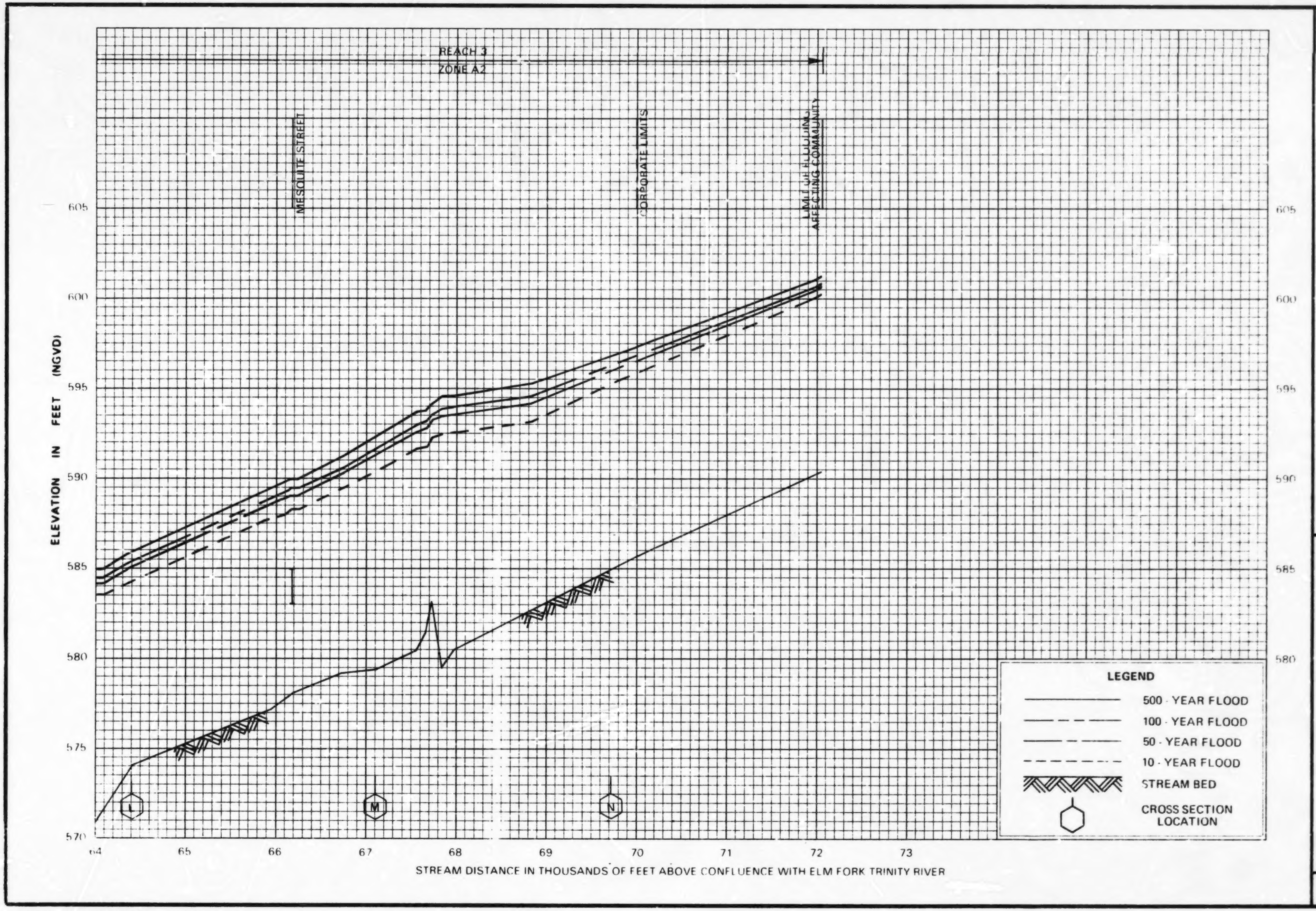

FLOOD PROFILES

TIMBER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX

(DENTON CO.)

12P

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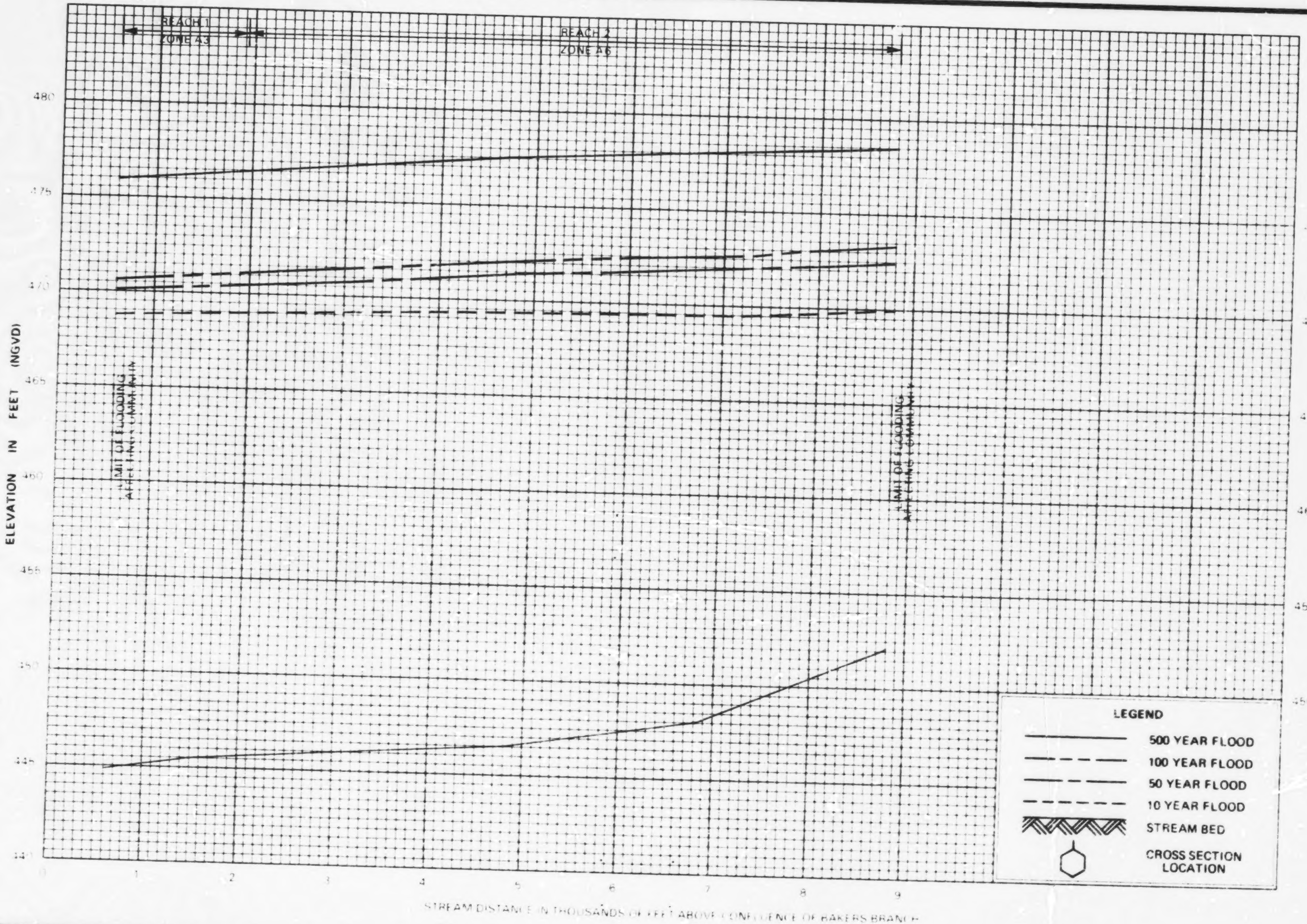

FLOOD PROFILES

DENTON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX
(DENTON CO.)

13P

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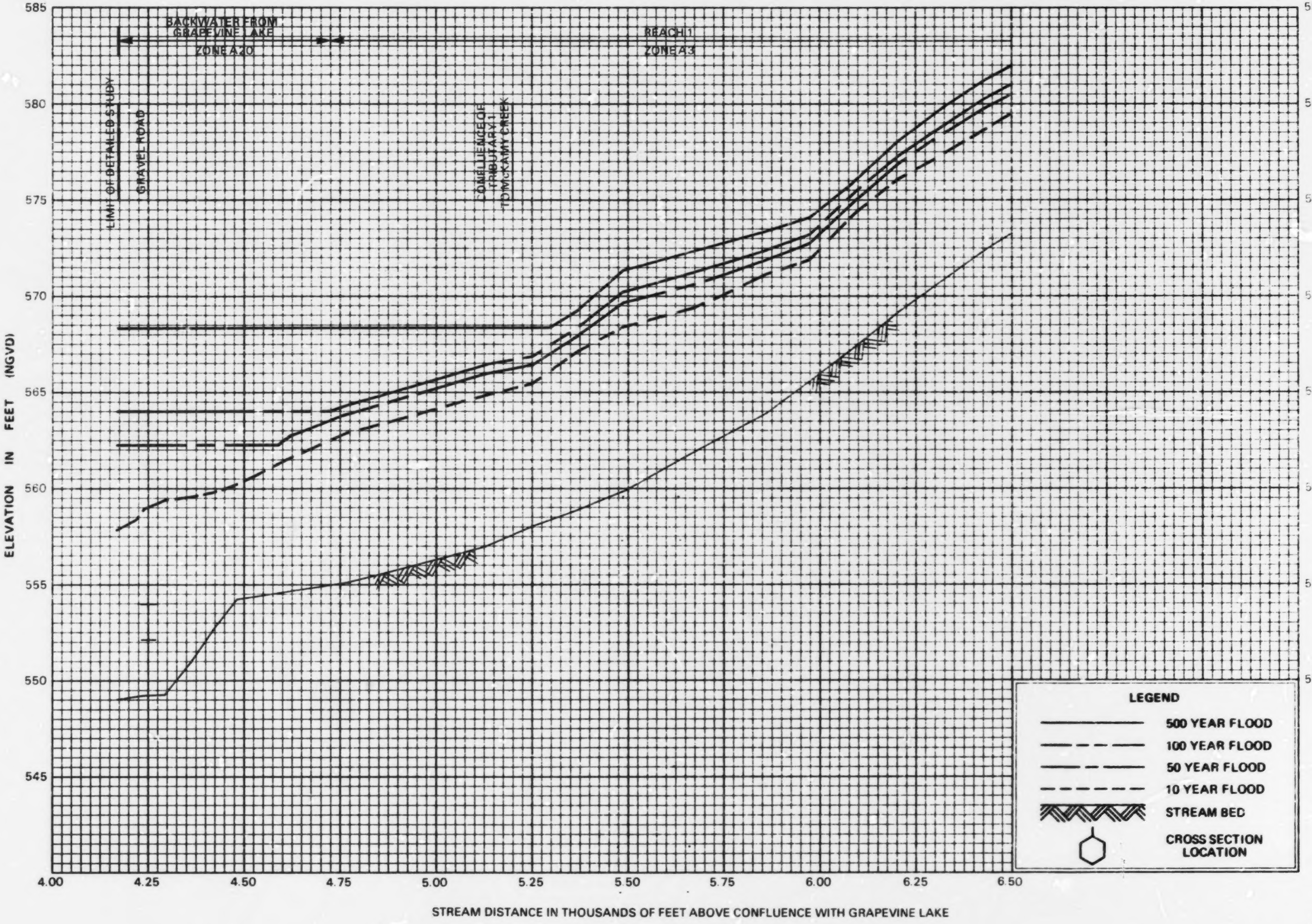

FLOOD PROFILES

MC KAMY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX
(DENTON CO.)

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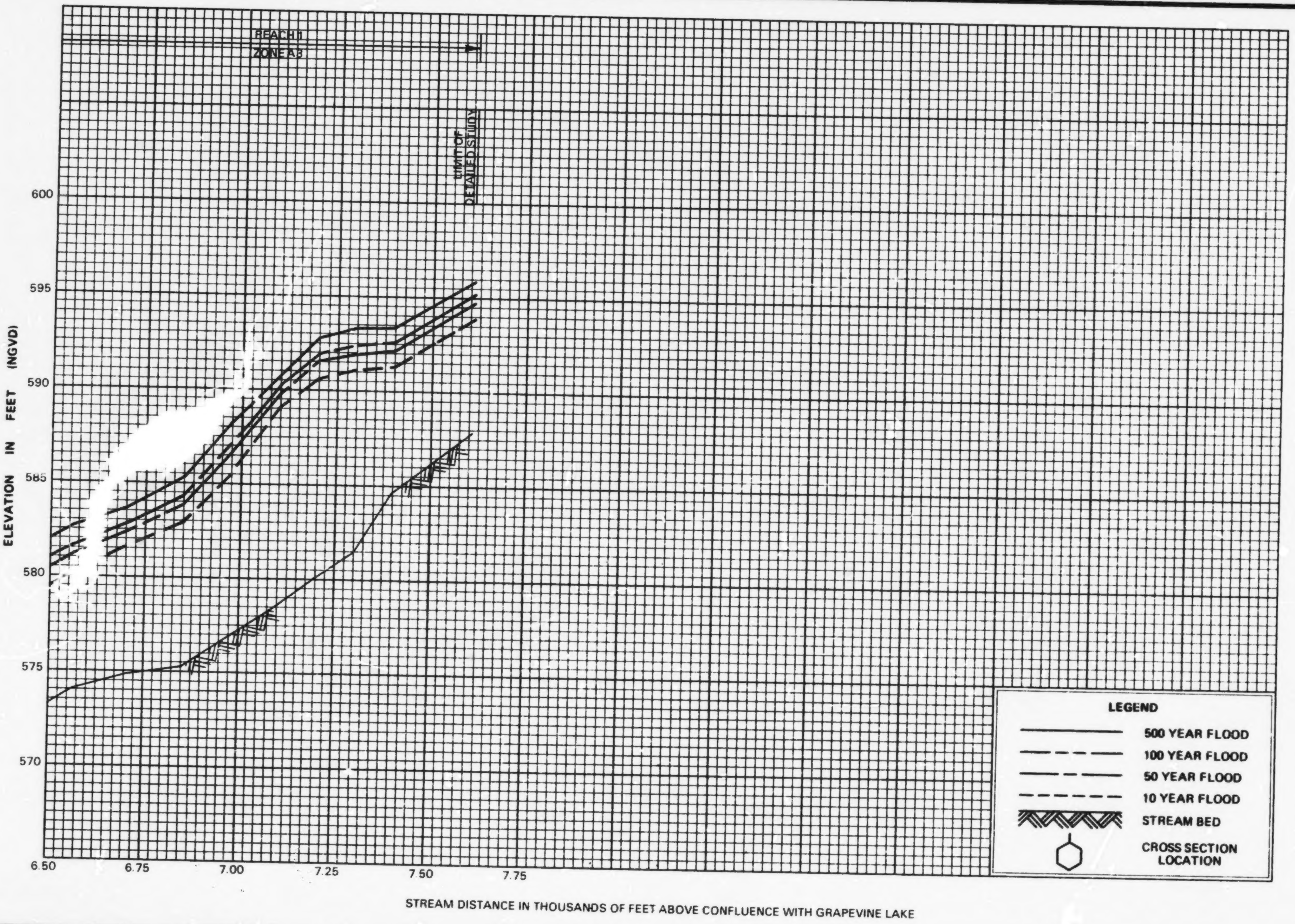

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX
(DENTON CO.)

FLOOD PROFILES

MC KAMY CREEK

15P

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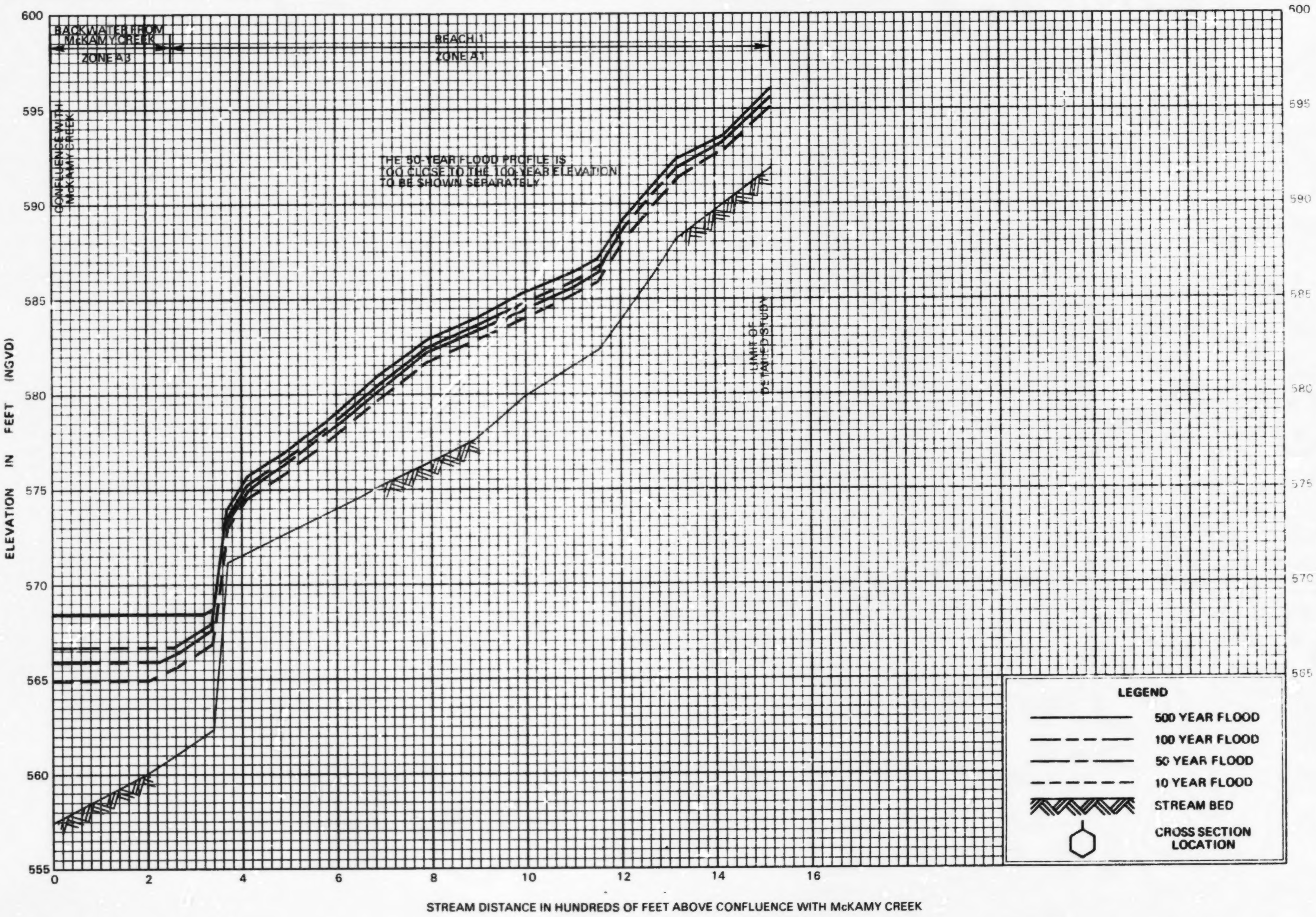

FLOOD PROFILES

TRIBUTARY 1 TO MC KAMY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF FLOWER MOUND, TX
(DENTON CO.)

16P

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